WHAT IS CLAIMED IS:

1. A power distribution system comprising:

an ac power source;

a power bus connected to the ac power source;

a capacitor bank shunt-connected to the power bus; and

an active filter shunt-connected to the power bus, the active filter including an inverter, an inverter control and current sensors, each current sensor sensing current flowing through a corresponding capacitor of the capacitor bank, the inverter control, in response to the current sensors, controlling the inverter to inject harmonic currents into the power bus.

2. The system of claim 1, wherein the inverter control controls the inverter to inject harmonic currents so as to eliminate harmonic currents in the capacitor bank.

3. The system of claim 1, wherein the harmonic currents are characteristic harmonic currents.

4. The system of claim 1, wherein the active filter supplies harmonic currents such that the ac power source supplies current to the power bus at a fundamental frequency only.

5. The system of claim 1, wherein the active filter includes a plurality of control loops, each control loop causing the filter to inject a different harmonic current into the power bus.

6. The system of claim 5, wherein each control loop generates a voltage command corresponding to a characteristic harmonic, and wherein

the active filter further includes means for summing the voltage command with a command corresponding to inverter voltage, and vector modulation logic, responsive to an output of the summing means, for controlling the inverter.

7. The system of claim 6, wherein the active filter derives reference frame rotators of the form $e^{sgn(jm\theta)}$, where m=(6n±1), different rotators being used by different control loops.

8. The system of claim 6, wherein each loop is responsive to a positive or negative sequence angle of the Park vector of capacitor bank current.

9. The system of claim 6, wherein within each control loop, the current Park vector is transformed to a reference frame that is synchronous with respect to positional angle (6n±1)θ of the fundamental; the resulting synchronous vector in the m^{th} synchronous reference frame is passed through a low pass filter, which filters out all frequencies; and the filtered signal is supplied to a PI regulator, which provides the voltage command for generating the corresponding harmonic current.

10. The system of claim 5, wherein the active filter further includes an inverter overcurrent regulator.

11. The system of claim 10, wherein the overcurrent regulator changes gain of the control loops in inverse proportion to an increase in overcurrent.

12. The system of claim 11, wherein overcurrent regulator operates on the control loops in parallel.

13. The system of claim 11, wherein overcurrent regulator operates on the control loops sequentially.

14. The system of claim 1, further comprising a dc link capacitor coupled across the inverter, wherein the inverter control also controls the inverter to maintain the dc link capacitor at essentially a constant and stable voltage.

15. The system of claim 14, wherein the inverter control generates an inverter vector command having a zero quadrature-axis component and a direct-axis component derived from dc link capacitor voltage; and includes an inner loop for regulating measured inverter current according to the inverter vector command.

16. The system of claim 15, wherein the inverter control includes a damping loop for modifying the inner loop to damp out non-characteristic oscillations on the capacitor bank.

17. The system of claim 16, wherein the inverter control further removes harmonic currents from a Park vector representing the measured inverter current.

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18. An active filter for a power distribution system, the system including a power bus, the filter comprising:

an inverter;

means for generating a plurality of different voltage commands, each voltage command corresponding to a different harmonic current;

means for summing the different voltage commands with a voltage command representing inverter voltage; and

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means, responsive to the summing means, for controlling the inverter to inject harmonic currents into the power bus.

19. An active filter for a power distribution system, the system including a power bus and a capacitor bank shunt-connected to the power bus, the filter comprising:

an inverter; and

a plurality of control loops, each control loop corresponding to a different multiple of capacitor bank Park Vector angle, each control loop causing the inverter to inject a different harmonic current into the power bus.

20. The active filter of claim 19, wherein each control loop generates a voltage command corresponding to a characteristic harmonic, and wherein the active filter further comprises means for summing the voltage command with a command corresponding to inverter voltage, and vector modulation logic, responsive to an output of the summing means, for controlling the inverter.

21. The active filter of claim 19, wherein within each control loop, a Park vector representing capacitor bank current is transformed to a reference frame that is synchronous with respect to positional angle $(6n\pm1)\theta$ of the fundamental; the resulting synchronous vector in the m^{th} synchronous reference frame is passed through a low pass filter, which filters out all frequencies; and the filtered signal is supplied to a PI regulator, which provides the voltage command for generating the corresponding harmonic current.

22. The filter of claim 19, further comprising an inverter overcurrent regulator for changing gain of the control loops in inverse proportion to an

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increase in overcurrent.

23. The filter of claim 19, further comprising a dc link capacitor coupled across the inverter, the dc link capacitor providing power to the inverter; and an inverter control for controlling the inverter to maintain the dc link capacitor at essentially a constant and stable voltage.

24. The active filter of claim 19, further comprising an inverter control for generating an inverter vector command having a zero quadrature-axis component and a direct-axis component derived from dc link capacitor voltage; and an inner loop for regulating measured inverter current according to the inverter vector command.

25. The active filter of claim 24, wherein the inverter control includes a damping loop for modifying the inner loop to damp out non characteristic oscillations on the capacitor bank; and logic for removing harmonic currents from the measured inverter current Park vector.

26. A method of using an inverter to filter harmonic currents on a power bus of a power distribution system, a capacitor bank being shunt-connected across the power bus, the method comprising:

measuring currents flowing through the capacitors of the capacitor bank; and

controlling the inverter to inject harmonic currents into the power bus in response to the measured currents so that the inverter supplies harmonic current demands of non linear loads on the power bus.

27. The method of claim 26, wherein voltage commands corresponding to multiple characteristic harmonics are generated, and wherein the voltage commands are summed with a command

corresponding to inverter voltage, and wherein the inverter is vector-modulated in response to the sum.